Shared Information and Virtual Surfaces

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TC3 Workshop

Cognitive and Neural Sciences

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Code 342

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Objective

- Investigate performance of self-synchronizing teams
- Understand how teams collaborate in situations characterized by high stakes, time pressure and uncertainty

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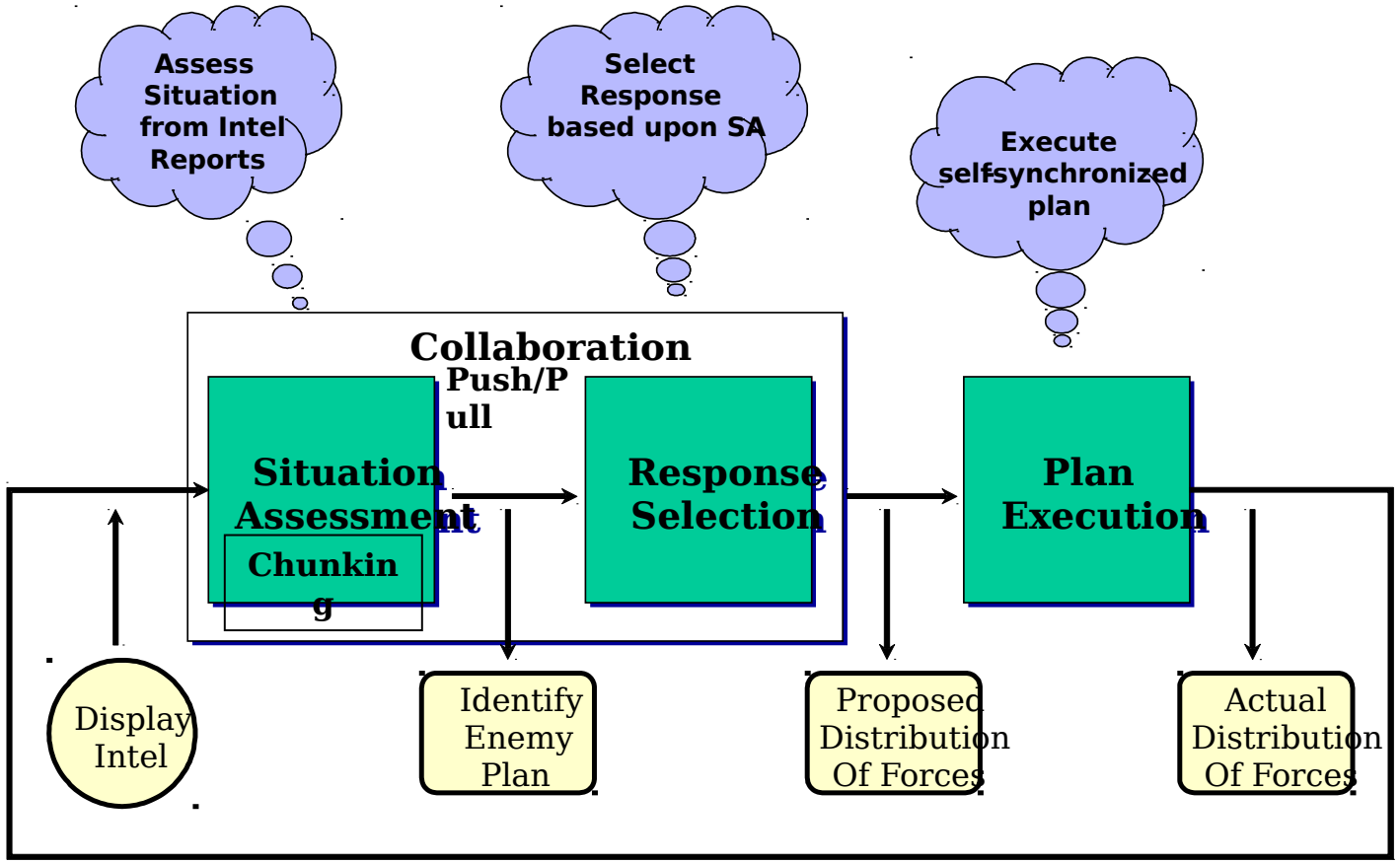
Research Model



Empirical investigation of our model of **Team Recognition Primed Decision Making**

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Team Compensatory Aids

- **Perception** Tools for
  - ***Pattern Recognition***
  - ***Sharing of Intention***
- **Attention** Tools for
  - ***Gesturing***
  - Alerting (negotiated)
  - Awareness
- **Memory** Aids for
  - Mitigating the Effects of Stress

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Research Measures

- Outcome Measures: *Quality, Speed*
- Process Measures:
  - *Pattern Recognition, Confidence*
  - *Information Sharing, Intention*
  - *Collaboration*
  - *Leadership*
- Mental Models: *Pathfinder C*

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Decision Game

- Cooperative 3-Player Game
- 7 Tokens, numbered 1-7
- Opponent has asymmetric force
  - Patterns: Definitive, Equivocal, Uncertain
- Team places tokens so total >= opponent

- Play is interactive

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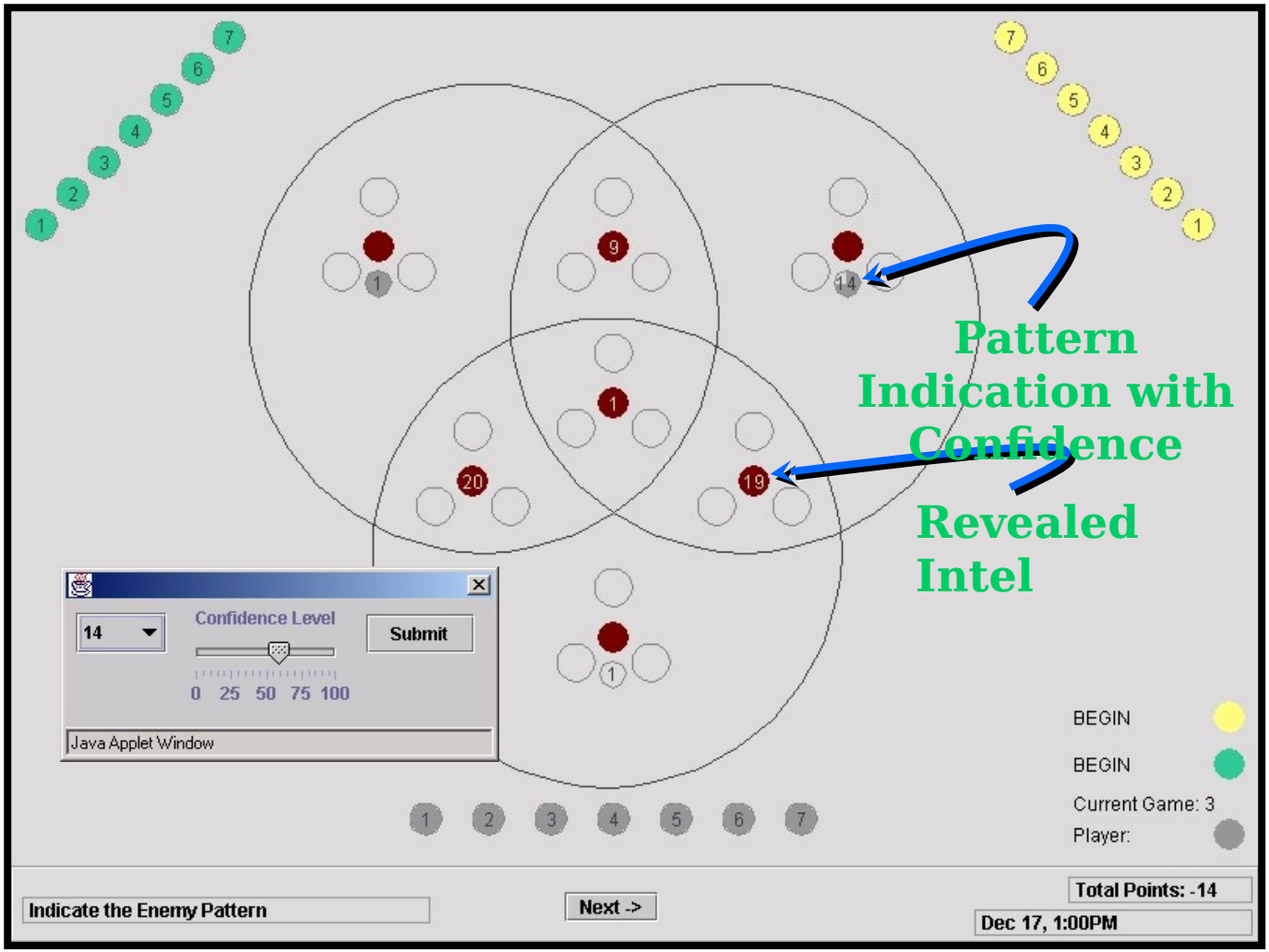
Game Screen



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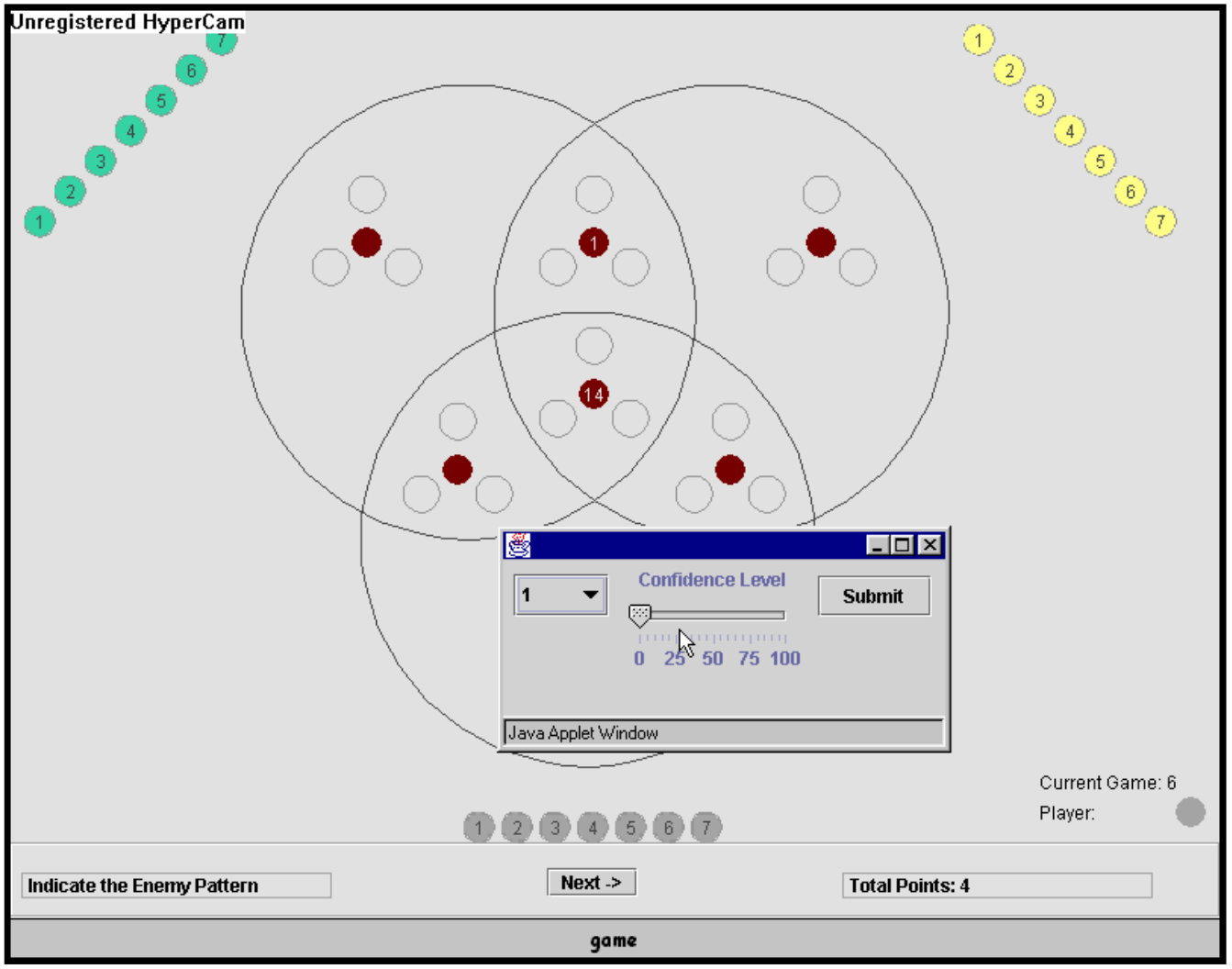
Video



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Current Progress

- Model and Software Developed
- Data Collected:
  - 144 Participants, 3 Treatments
- Analysis Performed
- Findings Reported

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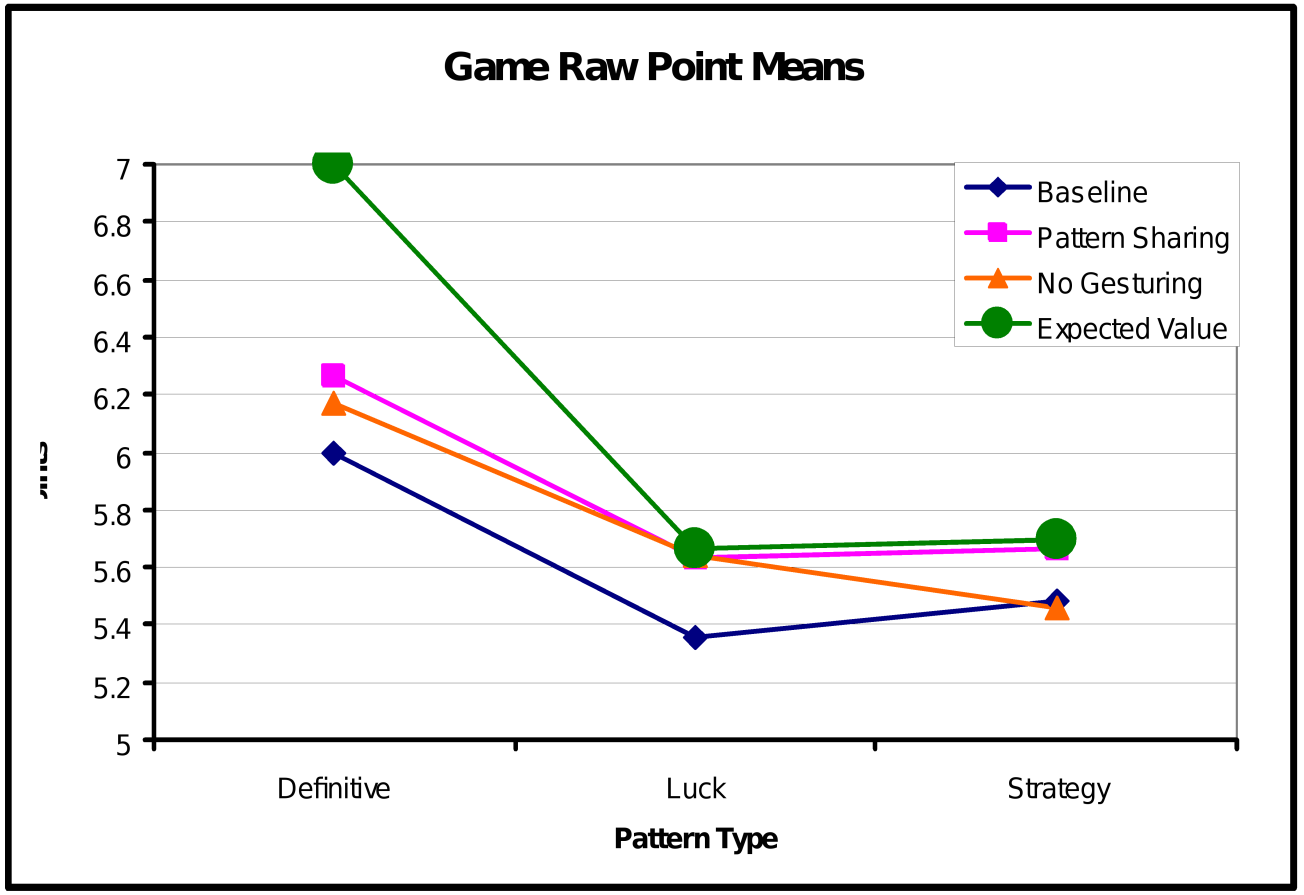
Raw Scores



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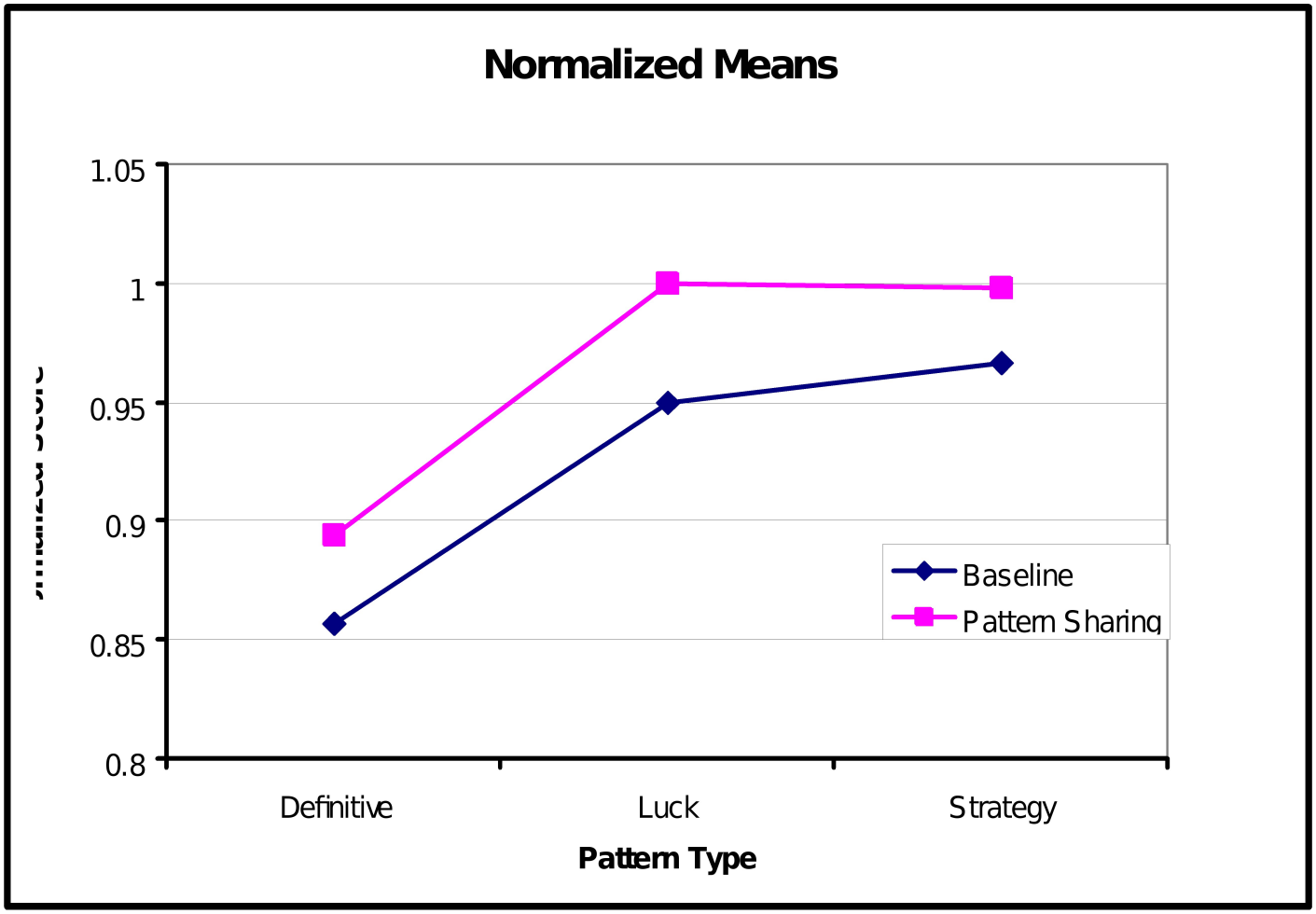
Normalized Scores



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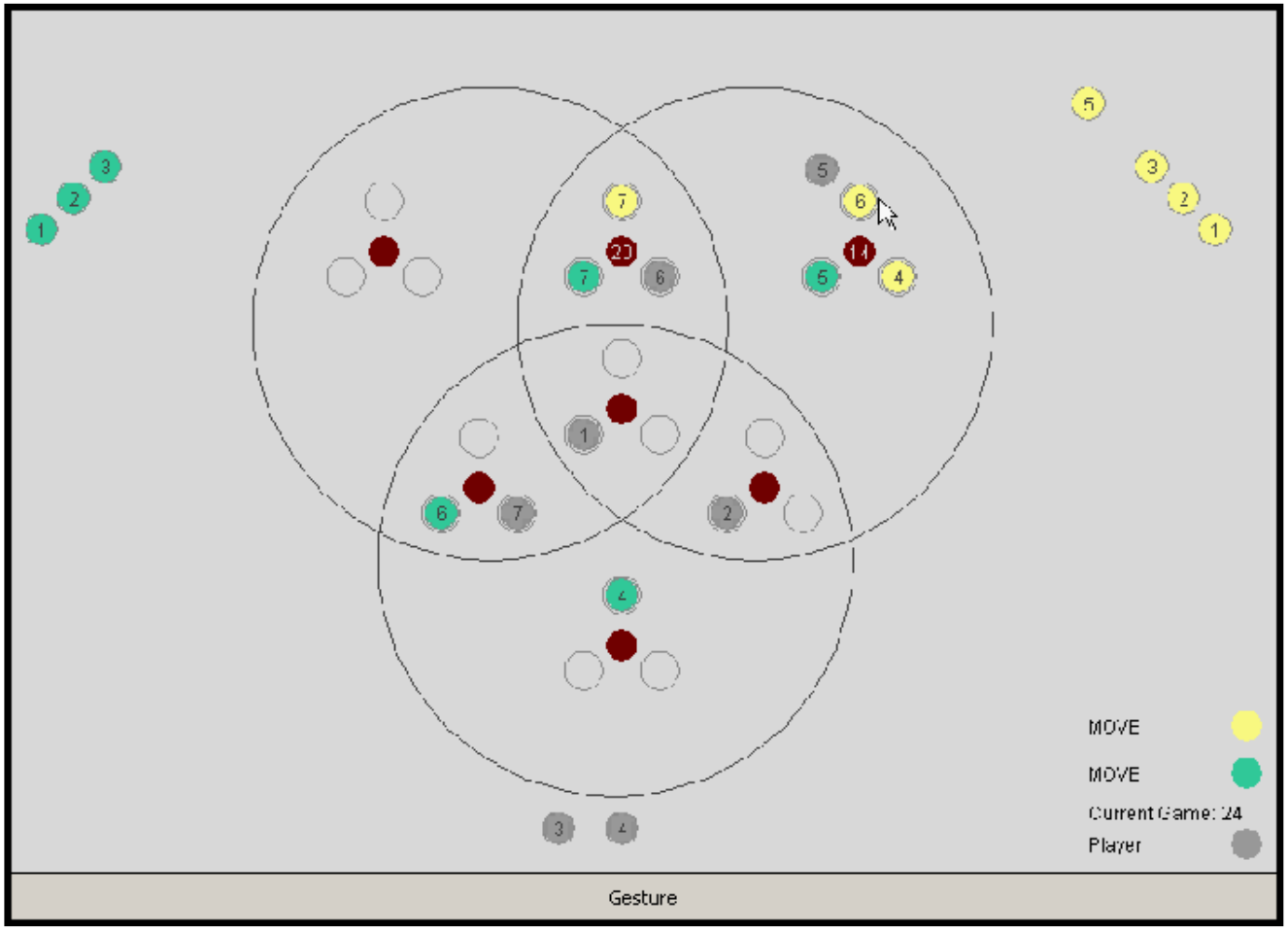
Gesturing Example



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Conclusions

- Team Recognition Primed Decision Making Model Validated
  - More time spent in situation assessment than in response selection
  - Pattern sharing reduces “extra” movement by 50%
  - Surprise finding wrt importance of real-time gesturing

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Research Issues

- Shared Mental Models
  - Similar or compatible knowledge
    Cannon-Bowers, J. E. & Salas, E. (2001) "Reflections on Shared Cognition", *Journal of Organizational Behavior*, 22(March):195-202
  - Consensus on who knows what
    Kraut, R. E., Lerch, F. J., & Fussell, S. R. *The Development of Shared Mental Models and Group Performance* (NSF IIS-9812123)

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Research Issues

- Team Cognitive Chunks
  - Slots and Templates

    Gobet, F. & Simon, H. A. (in press)
    "
    Five Seconds or Sixty? Presentation Time in Expert Memory
    ", Cognitive Science.
  - Labels and Mnemonics

    Staszewski, J. (1990). Exceptional memory: The influence of practice and knowledge on the development of elaborative encoding strategies. In F. E. Weinert & W. Schneider (Eds.), Interactions among aptitudes, strategies, and knowledge in cognitive performance, (pp. 252-285). New York: Springer.

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Research Issues

- Attention Management
  - Negotiated Alerts

    Horvitz, E., Jacobs, A., & Hovel, D. (1999) "*Attention-Sensitive Alerting*", In Proceedings of UAI '99, Conference on Uncertainty and Artificial Intelligence (pp. 305-313).
    McFarlane, D. C. (1999) "*Coordinating the Interruption of People in Human-Computer Interaction, Human-Computer Interaction*", INTERACT'99, Sasse, M. A. & Johnson, C. (Editors)
  - Information Push and Pull

    Cybenko, G. and Brewington, B. "*The Foundations of Information Push and Pull*," in The Mathematics of Information Coding, Extraction, and Distribution (G. Cybenko, D.P. O'Leary and J. Rissanen editors), Springer, IMA Volume 107, 1999.

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Research Issues

- Team Memory
  - Targets and Distractors
    Clark, S., Hori, A., Putnam, A., and Martin, P. (2000) "*Group Collaboration in Recognition Memory*", Journal of Experimental Psychology: Learning, Memory, and Cognition, 26(6):1578-1588.

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Research Issues

- What You See Is What I See (WYSIWIS)
  - Strict and Relaxed
    Stefik, M., Foster, G., Bobrow, D.G., Kahn, K., Lanning, S., and Suchman, L. (1987) "*Beyond the chalkboard: Computer support for collaboration and problem solving in meetings*", Communications of the ACM, 30(1):32-47.
  - Mutual Orientations
    Valin, S., Francu, A., Trefftz, H., Marsic, I. (2001). "*Sharing Viewpoints in Collaborative Virtual Environments*," In Proceedings of Hawaii International Conference on System Sciences, 3, 1-9.

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Research Issues

- Information
  - Common vs. Private
    Stasser, G., Vaughan, S., and Stewart, D., (2000). *"Pooling Unshared Information: The Benefits of Knowing How Access to Information Is Distributed Among Group Members,"* Organization Behavior and Human Decision Processes, 82(1):102-116.

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Research Issues

- Eye Tracking
  - Pupil Dilation and Cognitive Load
    Marshall, S. P., Morrison, J. G., Allred, L. E., Gillikin, S., & McAllister, J. A. (1997). *"Eye tracking in tactical decision-making environments: Implementation and analysis"*, in Proceedings of the 1997 Command and Control Research and Technology Symposium (pp. 347-355).

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FY '02 Research Plan

- Explore sharing of pattern chunks
  - Labels
  - Mnemonics
  - Templates (slots)
- Rewards for speed and accuracy

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